CSS-07-3001

CALIBRATION STANDARD REQUIREMENT

FOR A

PORTABLE HIGH TEMPERATURE CALIBRATOR

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PROCUREMENT PACKAGE

Prepared by: Naval Warfare Assessment Division
Measurement Science Directorate
Code MS-33
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1. SCOPE

1.1 Scope. This requirement defines the mechanical, electrical, and electronic characteristics for a Portable High Temperature Calibrator. This dry well type calibrator is intended to be used by Navy personnel in shipboard and shorebased laboratories to calibrate temperature instruments such as bi-metallic, liquid-in-glass and remote reading thermometers both in the laboratory and on-site. For the purposes of this requirement, the Portable High Temperature Calibrator shall be referred to as the PHTC.

2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, "Military Specification, Test Equipment for use with Electrical and Electronic Equipment, General specification for," and all documents referenced therein of the issues in effect on the date of this solicitation shall form a part of this requirement.

3. REQUIREMENTS

3.1 General. The PHTC shall conform to the Type II, Class 3, Style D requirements as specified in MIL-T-28800 for Navy shipboard and shorebased use as modified below. The use of material restricted for Navy use shall be governed by MIL-T-28800.

3.1.1 Safety. Protection from the hazards from Type III equipment, personnel safety and radiation control shall meet the requirements of MIL-T-28800, paragraphs 3.9 and 3.9.3

3.1.2 Design and Construction. The PHTC design and construction shall meet the requirements of MIL-T-28800 for Type II equipment.

3.1.3 Power Requirements. The PHTC shall operate from a source of 103.5V to 126.5V at 50 Hz and 60 Hz ± 5% single-phase input power.

3.1.3.1 Fuses or Circuit Breakers Fuses or circuit breakers shall be provided. If circuit breakers are used, both sides of the power source shall be automatically disconnected from the equipment in the event of excessive current. If fuses are used, only the line side of the input power line, as defined by MIL-C-28777, shall be fused. Fuses or circuit breakers shall be readily accessible.

3.1.3.2 Power Connection The requirements for power source connections shall be in accordance with MIL-T-28800 for a 6 foot (1.8 M) minimum length cord.

3.1.3.3 Plug-in Cabling. All plug-in cabling shall be capable of being connected and disconnected without disassembly or removal of adjacent components.

3.1.4 Dimensions and Weight. Maximum dimensions shall not exceed 18 inches (46 cm) in width, 12 inches (31 cm) in height, and 14 inches (36 cm) in depth. The PHTC weight shall not exceed 44 pounds (21 Kg).

3.1.5 Lithium Batteries Lithium batteries with the following characteristics are authorized for use in the equipment:

a. Lithium batteries with no more than two cells with a rated, electrical capacity of less than 200 milliampere hours per cell and if the battery is protected from other sources of electrical power by appropriate blocking diodes, fuses and/or resistors, or if there is no other source of electrical power to the unit.

b. Lithium batteries of the lithium/carbon monoflouride or lithium/maganese dioxide chemistries with no more than two cells in series with a rated electrical capacity of less than 1.25 ampere hours per cell and if the battery is protected from other sources of electrical power.

c. For equipment which carries the approval of Underwriter's Laboratories, lithium batteries of no more than two cells with a capacity of no more than 1.5 ampere hour each.

3.1.6 Asbestos. The PHTC shall not contain or require the use of asbestos.

3.2 Environmental Requirements. The PHTC shall meet the environmental requirements for a Type II, Class 3, Style D equipment with the deviations specified below.

3.2.1 Temperature and Humidity. The PHTC shall meet the conditions below:

	Temperature (°C)	Relative Humidity (%)
Operating	10 to 30	95
	30 to 40	75
Non-operating	-20 to 70	Not Controlled

3.2.2 Altitude. The requirements of MIL-T-28800, paragraph 3.7.3 are applicable.

3.2.3 Vibration. The requirements of MIL-T-28800, paragraph 3.7.4.1 for sinusoidal vibration are applicable.

3.2.4 Shock, Mechanical. The requirements of MIL-T-28800, paragraphs 3.7.5.1 for functional shock, 3.7.5.2 for transit drop and 3.7.5.3 for bench handling are applicable.

3.2.5 Water Resistance. The drip proof requirements of MIL-T-28800, paragraph 3.7.6.3 are applicable with cover on.

3.2.6 Acoustic Noise. The requirements of MIL-T-28800, paragraph 3.7.12 are applicable.

3.2.7 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE03, CS01, CS02, CS06, RE01, RE02 (14 kHz to 1 Ghz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Calibration Interval. The PHTC shall have an 85% or greater probability of remaining within tolerances of all specifications at the end of a 12 month period.

3.4 Maintainability. The PHTC shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete component shall be defined as a replaceable assembly. Certification time shall not exceed 2 hours.

3.5 Performance Requirements. The PHTC shall provide the following capability as specified below. Unless otherwise indicated, all specifications shall be met following a 30-minute warm-up period.

3.5.1 Temperature. The PHTC shall be capable of generating, measuring and selectively displaying the output temperature in degree Fahrenheit (°F) and degrees Centigrade (°C).

3.5.2 Output Temperature Range. The output temperature range as measured in the temperature well shall be, as a minimum, 100 °F to 1200 °F (38 °C to 649 °C)

3.5.3 Uncertainty. The uncertainty of the output temperature, as measured in the temperature well, shall be equal to or less than ± 0.8 °F (± 0.45 °C) over the temperature range from 100 °F to 600 °F (38 °C to 333 °C) and ± 0.15% of set point in the temperature range from 600 °F to 1200 °F (333 °C to 649 °C). The uncertainty includes all effects of linearity, hysteresis, repeatability and ambient temperature.

3.5.4 Resolution. The resolution of the displayed output temperature shall be a minimum of 0.1° when operating over the specified range.

3.5.5 Settability. Settability is defined as the ability to set the output temperature, without overshooting, to an exact cardinal test point within specified tolerance. The settability of the PHTC shall be ± 1.0% or less of the indicated value.

3.5.6 Temperature Gradients. The temperature in the temperature well shall be uniform to within 0.25% of the reference temperature

when measured at any point within the active or controlled area of the temperature well.

3.5.7 Temperature Stabilization Time. The output temperature shall stabilize within 30 minutes when the temperature set point is increased 1100 °F (611 °C) from ambient temperature.

3.5.8 Set Point Stability. The output temperature, as measured in the temperature well, shall remain stable to within ± 0.15 °F (± 0.08 °C) for at least one hour.

3.5.9 Temperature Runaway. The PHTC shall have a safety feature which interrupts power to the unit, except for any cooling fans, when the well temperature exceeds 1220 °F (660 °C) or when the internal circuitry reaches an overheating condition.

3.6 Operating Requirements. The PHTC shall provide the following capabilities.

3.6.1 Front Panel Control Requirements. All modes and functions shall be operable using front panel controls. The locations and labeling of indicators, controls and switches shall provide for maximum clarity and easily understood operation without reference to tables, charts or flow diagrams.

3.6.1.1 Input Power Indicator. A visual power indicator shall be provided on the front panel of the PHTC to indicate when the equipment is energized.

3.6.1.2 Front Panel Display Indicator. A visual indication shall be provided on the front panel of the PHTC to indicate when the output temperature has reached a preselected value.

3.6.1.3 Display Requirements. The PHTC shall have a alpha-numeric display that has a minimum of 40 characters.

3.6.2 Programmability. All modes and functions shall be operable via the IEEE-488.1 instrumentation bus. When operating the PHTC via remote programming, all front panel controls shall be disabled, except the on/off switch and the Remote/Local switch

3.6.3 Local/Remote. The PHTC shall have a local and remote operational mode. It shall be either manually or remotely programmable selectable according to paragraph 3.6.2. When changing modes, all parameter values shall remain unchanged.

3.6.3.1 Remote Calibration and Standardization. The PHTC shall be capable of being calibrated and/or standardized remotely via the IEEE interface.

3.6.4 IEEE Interface. The PHTC shall have an IEEE-488.1 interface connector with the following capabilities: SH1, AH1, T6, L4, SR1, RL1, DT1. Serial poll capability shall be provided

3.7 Printer. The PHTC shall have an on-board dot matrix printer that utilizes standard adding machine paper. One replacement printer cartridge shall be included.

3.8 Keyboard. The PHTC shall provide a keyboard for setting the desired output temperature in at least one degree increments throughout the specified range. Once the temperature is set, the display shall show when the set temperature is reached.

3.9 Dry Well Interface Requirements. The PHTC shall contain a dry temperature well that will accept the probes of the thermometers specified in Section 3.10. The physical interface shall be such that the heat loss between the PHTC and thermometer does not degrade the accuracy of the PHTC. Thermal conductive liquid or grease shall not be used as a thermal transfer material.

3.10 Compatibility. The PHTC shall meet the following compatibility requirements.

3.10.1 Temperature Sensors. The PHTC shall be capable of calibrating the thermometers specified in Federal Specification GG-T-321 and Military Specifications MIL-T-17244 and MIL-T-19646 that have full ranges within the output temperature range of the PHTC.

3.10.2 Calibration Standard. The PHTC shall be physically compatible with the Navy authorized temperature transfer standard, the Rosemount Model 162CE Platinum Resistance Thermometer.

3.10.3 Controller Compatibility. The PHTC shall be tested for compatibility with the IEEE-488.1 interface and the Fluke 1722A and 1722A/AP Instrument Controllers.

3.10.4 Instrument Calibration Procedures. The PHTC shall be compatible with all NAVAIR 17-20(Series) Instrument Calibration Procedures in effect on the date of this solicitation which require a dry well temperature calibration standard with a accuracy of ± 1.0 °F (± 0.54 °C) or better and within the temperature range specified in 3.5.2 for calibrating bi-metallic, liquid-in-glass and remote reading thermometers.

3.11 Enclosure. The PHTC shall be installed in one enclosure. The enclosure shall meet the Type II, Class 3, Style D requirements on MIL-T-28800, except the external power connection shall be on the front panel.

3.12 Accessories. The following accessories shall be provided with each PHTC.

3.12.1 Power Cable. One power cable in accordance with MIL-T-28800, with minimum length of 6 feet (1.8 meters).

3.12.2 Adapter Set. The PHTC shall contain all adapters required to accommodate the thermometers specified in Section 3.12. The adapter set shall also include adapters with bore diameters of 1/4 inches, 3/8 inches, 7/16 inches, 9/16 inches. All adapters shall be permanently marked with a unique number or letter.

3.12.3 Adapter Handling Tool. One adapter handling tool to handle hot adapters.

3.12.4 Caliper. One vernier caliper (for measuring adapter and thermometer diameters).

3.12.5 Continuity Tester. One continuity tester (for checking operation of thermal switches).

3.12.6 Storage. All accessories and the Operation and Maintenance Manual shall be stored in the enclosure or enclosure cover.

3.13 Manual. At least two copies of an operation and maintenance manual shall be provided. The manual shall meet the requirements of MIL-M-7298.

3.13.1 Calibration Procedure. A calibration procedure in accordance with MIL-M-38793 shall be provided.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. The PHTC shall be tested in accordance with the bid sample tests specified in MIL-T-28800 for Type II, Class 3, Style D equipment. The bid sample tests shall include those tests specified in MIL-T-28800 except where modified below as well as the tests specified in the following paragraphs.

4.2 Group A Tests. Group A tests shall include the tests specified in MIL-T-28800 as modified below.

4.2.1 Pre-operational Inspection. The pre-operational inspection shall be in accordance with MIL-T-28800 and shall include a verification of the condition and acceptability of the accessories specified in 3.10.

4.2.2 Level A Performance. Level A performance tests of MIL-T-28800 paragraph 4.5.3.2 are applicable.

4.3 Group C Tests. Group C tests shall include the tests specified in MIL-T-28800 as modified in 4.4.1 through 4.4.5 below.

4.3.1 Temperature and Humidity (T/H). Perform a T/H test in accordance with MIL-T-28800 for Class 3 equipment as modified by the operating and non-operating conditions specified in 3.2.2 of this specification. Verify that the PHTC meets the performance requirements of the T/H testing.

4.3.2 Altitude. MIL-T-28800, paragraph 4.5.5.2 is applicable.

4.3.3 Vibration. MIL-T-28800, paragraph 4.5.5.3.1 sinusoidal vibration test is applicable.

4.3.4 Transit Drop. Perform a transit drop test in accordance with MIL-T-28800 for Type II, Style C equipment using a drop height of 6 inches (15 cm). Verify that the PHTC meets the performance requirements of the operation test after being subjected to the transit drops.

4.3.5 Water Resistance. Perform a drip-proof test in accordance with MIL-T-28800 for Type II, Style C equipment. Verify that the PHTC meets the performance requirements of the operation test after being subjected to the drip-proof test.

4.3.6 Electrical Power. Perform the electrical power tests in accordance with MIL-T-28800 for Type II equipment. Verify that the PHTC meets the performance requirements specified.

4.3.7 Group C Verification. Perform the Group C verification tests in accordance with MIL-T-28800. Group C verifications tests shall include Level A performance tests specified in 4.2.3.

4.4 Group D Tests. Group D tests shall include the tests specified in MIL-T-28800 as modified below.

4.4.1 EMI. Perform EMI tests in accordance with MIL-T-28800 for Type II, Class 3 equipment as modified by the compatibility requirements of 3.2.7.

4.4.2 Group D Verification. Perform the Group D verification tests in accordance with MIL-T-28800. Group D verification tests shall include Level A performance tests specified in 4.2.3.

4.6 Group E Tests. Group E tests shall include the tests specified in MIL-T-28800 as modified below.

4.6.1 Marking and Identification. Verify that the PHTC and all component parts conform to the marking and identification requirements of MIL-T-28800.

4.7 Group F Tests. Group F tests shall include the tests specified in MIL-T-28800 as modified below.

4.7.1 Reliability. Documentation shall be submitted with the bid samples to show how the reliability characteristics of the PHTC comply with MIL-T-28800. Verify that the PHTC conforms to the reliability requirements of MIL-T-28800.